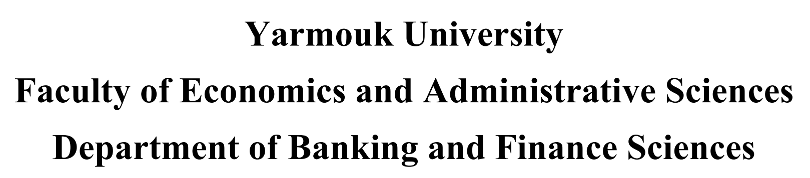




Yarmouk University
Faculty of Economics and Administrative Sciences
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The Impact of Financial Constraints on Inventory Investment: Empirical Study from Jordan

"أثر القيود المالية على الاستثمار في المخزون السلعي: دراسة عملية من الأردن "

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Program: Master in Banking & Finance Sciences

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Dedication

After thanking Allah for the completion of this thesis, I would like to dedicate it to my parents, for their matchless efforts that I can never pay back their caring and kindness. To my uncle Mohammad Shaban for his encouragement all the time. To my brother & my sisters. To my darling wife for her countless support and encouragement, which has a great influence in accomplishing this work. To my sons and my daughter, god bless you all. To all of my relatives & colleagues, and finally, to everyone who encouraged me.

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No words would express my appreciation to my advisors Dr. Mohammad Gharaibeh and Dr. Ziad Zurigat, special thanks, and sincere appreciation offered to them for accepting me to be their student in this thesis, and for their guidance, caring, patience, and the time they dedicated to my work, I would like also to thank them for their efforts in reading, commenting, and providing valuable advice, and ideas, which have a great impact on the completion of this thesis.

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Table of Contents

List of Tables

List of Appendixes

Abstract

Ananbeh, R'ad, S. "The Impact of Financial Constraints on Inventory Investment: Empirical Study from Jordan". Master Thesis, Yarmouk University, 2014. (Supervised by Dr. Mohammad Gharaibeh and Dr. Ziad Zurigat).

This study aims at investigating the impact of financial constraints on inventory investment, along with determining whether Jordanian industrial firms have a target inventory level, and how fast they move toward that target when any deviation exists. In addition, it investigates whether the financial constraints have an impact on the target inventory level, and the speed of adjustment toward it.

By using the panel data analysis for 50 industrial firms listed on Amman Stock Exchange (ASE) over the period (2001-2011), and the partial stock adjustment model, the results suggest that Jordanian industrial firms have a target inventory level. However, Jordanian industrial firms adjust their actual inventory holding to their target level slower than their counterparts in developed and developing countries. Moreover, the study reveals that financial constraint affects inversely the adjustment speed, and makes the financially constrained firms reduce their level of inventory beyond the target by more than the financially unconstrained firms.

Keywords: Inventory Investment, Financial Constraints, Pecking Order Theory, Amman Stock Exchange.

الملخص

عنانبه، رعد، سليمان. "أثر القيود المالية على الاستثمار في المخزون السلعي: دراسة عملية من الأردن". رسالة ماجستير، جامعة اليرموك، 2014.(المشرف الدكتور محمد الغرايبه والدكتور زياد زريقات)

تهدف هذه الدراسة إلى بيان أثر القيود المالية على الاستثمار في المخزون السلعي، بما في ذلك التحقق فيما إذا كانت الشركات الصناعية الأردنية لديها مستوى أمثل للمخزون السلعي وأنها تنتقل تدريجيا نحو هذا المستوى الأمثل عند الانحراف عنه، وكذلك التحقق فيما إذا كان للقيود المالية أثر على المستوى الأمثل للمخزون السلعي وعلى سرعة الوصول إليه.

باستخدام السلاسل الزمنية المقطعية (Panel Data) لعينة مكونة من 50 شركة صناعية مدرجه في بورصة عمان للأوراق المالية خلال الفترة الزمنية (2001 -2011)، واستخدام نموذج التعديل الجزئي للمخزون السلعي، فقد خلصت الدراسة إلى عدد من النتائج، أهمها: أن الشركات الصناعية الأردنية لديها مستوى أمثل للمخزون السلعي وأنها تنتقل إلى هذا المستوى الأمثل عند الانحراف عنه، وأن سرعة الانتقال إلى المستوى الأمثل في هذه الشركات أقل من مثيلاتها في الدول المتقدمة والنامية. وعلاوة على ذلك، فقد بينت الدراسة أن القيود المالية لها تأثير سلبي على سرعة الانتقال إلى المستوى الأمثل، كما أنها تجعل الشركات المقيدة ماليا لخفض مستوى المخزون لديها إلى ما دون المستوى الأمثل بشكل اكبر مقارنة بالشركات غير المقيدة ماليا.

الكلمات المفتاحيه: الاستثمار في المخزون، القيود المالية، نظرية أولويات مصادر التمويل، بورصة عمان للأوراق الماليه.

Chapter one

Introduction

1.1 Introduction

Firms hold inventory in order to smooth their operations. Allen & Pollmann (1997) argue that, First, inventories allow firms to meet their excessive demand without having to adjust outputs immediately. When the marginal cost of production increases, firms can use their inventory in order to smooth their production without attempting to adjust it, as long as the cost of adjusting production is more than the holding costs of inventories. Second, inventories act as a buffer stock by absorbing the increase in demand, while production remains steadily.

Several models are used to explain the behavior of inventory, such as production-smoothing model, (S,s) model (Obembe *et al.*, 2012), and stock-adjustment model (Lovell, 1961). According to Eichenbaum (1989), the basic hypothesis behind the production smoothing model is that firms hold inventories in order to smooth their production in case of fluctuating in demand, and increasing in cost of productions. Iturriage (2000) argues that in order to be in line with production smoothing model, sales must be more volatile than productions. Hence, sales and

inventory investment should be negatively related. However, few studies met the production smoothing model requirements, while most of studies found that the variance of production exceeds the variance of sales[1]. Moreover, several studies find that sales and inventory investment are positively correlated (see for example, Iturriage, 2000 ; Obembe *et al*.,2012 ; Blinder & Maccini,1991). While, other studies found they are negatively related (Cunha & Paisana,2011; Allen & Pollmann,1997).

The (S,s) model indicates that firms adjust their inventory to the upper limit “S”, whenever it hits the lower limit “s”. (Blinder & Maccini, 1991).

The optimal level of inventory firm tries to maintain, depends on the trade-off between its benefits and its costs. To reach the optimal level, firms must maximize benefits and minimize the cost of inventory. According to Mathuva (2013), the size of optimal inventory order is determined by the marginal benefits and costs of holding inventory.

Lovell’s target adjustment model (1961), assumes that each firm identifies its optimal level of inventory relative to the sales they would

1 See for example, Eichenbaum,1989 ; Blinder & Maccini,1991; Blanchard,1983 ; Kahn,1987; Kahn,1992; Allen & Pollmann,1997.

like to maintain by making a partial adjustment when any target deviation exists. According to Lovel (1961), adjustment toward the target level of inventory partially takes place because of, First, the costs involved in changing the level of stocks. Second, the heterogeneous nature of stocks; stocks are replaced at infrequent intervals. As well as, Yue (2011) shows that the immediate adjustment to desired level requires a premium on purchasing costs, due to fast delivery in small amounts.

The presence of capital market imperfection restricts firms from generating funds externally. Hence, any fluctuation in the internal funds will affect the firms fixed investment and inventory investment, by restricting them from financing all of their positive investment, and thereby, their inventory holdings. Muthuva (2013) shows that inventory holdings are influenced by the firm's ability to generate internal recourses. Moreover, the speed of target adjustment depends on how severe market frictions are. Firms that have little friction in accessing the market will move toward their target level faster than others.

The underlying argument behind the above discussion is that firms' investment in inventory may depend on whether they are financially constrained or not. The presence of market frictions such as agency costs, information asymmetry, transaction costs, and bankruptcy costs make external funds more expensive than internal funds

Povel and Raith (2002) show that changes in internal funds and information asymmetry have different effects on the marginal cost of external funds, and therefore the firm's optimal investment. More asymmetric information generally makes firms lower their investment, and causes a greater sensitivity of investment to changes in internal funds. This is supported by Cunha and Paisana (2011), who argue that the imperfections in capital markets can hinder firms from accessing to external funds, leading to fluctuations in inventory investment, moreover, firms prefer to reduce inventory investment, when they are confronted with a negative shock in internal finance, than reduce the fixed investment.

When firms face bad micro events, they have a different choice to act, such as changing the level of employment, reducing their fixed

investment or changing its inventory investment. Because of the low adjustment costs of inventories relative to other forms of investment, inventory investment will be more effected. Empirically, Hubbard (1998) argues that the reduction in inventory investment will be larger than the reduction in fixed capital in respond to fall in net worth, because of lower adjustment costs of inventory relative the adjustment costs of fixed capital.

Most of the empirical studies focused on the relationship between the financial constraints and the fixed investment, with less attention to the effect of financial constraints on inventory investment.

This research aims at contributing to the empirical literature by investigating the impact of financial constraints on inventory investment, which might force firms to hold inventory beyond their target level, and determining whether industrial firms have an optimal level of inventory, and how fast they move towards it, when any deviation exists, for a panel of Jordanian manufacturing firms listed in Amman Stock Exchange (ASE) over the period (2001-2011).

1.2 Problem of the Study

The presence of the market impediment such as asymmetric information, agency costs, transaction costs, and bankruptcy costs make the capital market imperfect. This makes external funds more expensive than internal funds, and restrict firms in accessing external funds, and consequently affect their inventory holdings. Muthuva (2013) concludes that inventory holdings are influenced by the firm's ability to generate internal recourses.

In Jordan, the capital market is imperfect. It faces various market friction such as asymmetric information, agency cost, and bankruptcy cost, that affect a firm's investment, including inventory investment. Therefore the study seeks to answer the following questions:

- Do Jordanian firms have optimal (target) level of inventory, and how fast do they move toward it if any deviation exists?
- Do financial constraints have any impact on inventory investment, as well as the speed of adjustment?
- Do financial factors have an impact on inventory investment?

1.3 Importance of the Study

In spite of the small magnitude of inventory relative to total production, the decline in inventory during the economic recession is considered to be an important portion of the declining in the Gross Domestic Product (GDP) (Yue, 2011).

Moreover, inventory investment as a current assets is one of the important elements in working capital. According to (Ranganatham, 2011), it forms more than 50% of current asset. Therefore, efficient management of inventory investment will have lead to efficient working capital management, which has a significant impact on the profitability of firms. Inventory investment need to be financed externally or internally, so it might depend on whether the firms are financially constrained or not.

Hence, the importance of this study rises from its role to investigate the effect of financial constraints on inventory investment in Jordan as one of the developing countries, which might have an impression on the optimal level of inventory, and the speed of adjustment toward the optimal level when any deviation exists.

To the best of the researcher knowledge, the current study is the first one that attempts to investigate the impact of financial constraints on inventory investment in the context of Jordan, including identifying whether Jordanian firms have a target level of inventory, and how fast they adjust toward it when any deviation exists.

1.4 Objectives of the Study

The aim of this study is to investigate whether Jordanian firms have an optimal level of inventory, and how fast they move toward it if any deviation exists. It also aims at investigating whether the financial constraints have an impact on inventory investment, by determining the effect of it, on the optimal level and the speed of adjustment. So, the main objectives of this study can be summarized as follows:

- Investigating whether Jordanian firms have a target inventory level.
- Estimating the adjustment rate of moving towards the target level, and identifying whether the financial constraints do have any impact on it.

- Analyzing whether the financial variables (Cash Flow, Leverage Ratio) have an impact on inventory investment decision.

To accomplish these objectives, a sample of 50 Jordanian industrial firms in different industrial sectors, listed on ASE during the period 2001-2011, are used to test the partial adjustment method of lovell's model (1961) using pooled and panel data analysis.

1.6 Structure of the Study

This study will contain six chapters. Beginning with chapter one that presented the introduction, importance, objectives, and problem of the study. The second chapter demonstrates the theoretical framework. The third chapter covers the literature review on inventory investment and financial constraints. The fourth chapter describes data, methodology, variables and their measurement. The fifth chapter includes the estimation results. The last chapter summarizes the recommendations and conclusions.

Chapter Two

Theoretical Framework

2.1 Introduction

Firms need to raise funds in order to finance their several kinds of investment, including inventory. In a world of perfect capital market, such investments will be relevant to a firm's financial status. Fazzari *et al.* (1988) show that because of the imperfection of capital market, the level of firm's investment that suffering from financial constraints can vary, depending on their availability of internal funds. Also, Fazzari & Athey (1987) show that since the cost of external financing is higher than the cost of internal financing, this can constraint the firm's investment level.

2.2 Working Capital Management

According to Besley & Brigham (2008, p 566), "working capital management involves the management of short-term assets (investment) and liabilities (financing sources)". Consequently, "it involves the decision of the amount and composition of current assets and the financing of these assets", (Muhammad *et al.*, 2012, p 156). The current assets represent the portion of investment which convert from one form

to another, while the current liabilities include the firm's short-term financing which include all the debt that must be paid in one year or less, (Gitman, 2009). Current assets (short-term assets) include inventory, accounts receivable, cash, and marketable securities.

According to Gitman (2009), the aim of short-term financial management for both current assets and current liabilities, is to achieve a balance between profitability and risk, which contributes positively to firm's value. Therefore, an efficient management of working capital has a positive effect on the firm's value. Aminu & Zainudin, (2012, p 730) state that, "efficient and effective management of working capital is an important component of overall corporate strategy to create value for the business".

Empirically, Muhammad *et al*. (2012) find a positive relationship between cash management, accounts receivable, inventory and the profitability of firms; they conclude that an efficient working capital management leads to increasing the profitability of the firm. Moreover, Bagchi et al. (2012) aim in their research to explore the impact of components of working capital like cash conversion cycle (CCC), age of inventory (AI), age of debtors (AD), age of creditors (AC),……etc on the profitability of the firm. They find a negative relationship between

cash conversion cycle, age of inventory, age of credit, age of debtors and the profitability of firms.

Because of the importance of working capital management, firms should formulate a clear policy related to the level of investment in each of their components. According to Besley & Brigham (2008) investment in current assets can be performed through three policies, relaxed current asset investment policy, restricted current asset investment, moderate current asset investment. Under the relaxed (conservative) policy, large amounts of cash, marketable securities, and inventories are carried. It decreases the risk associated with financial problems or shortage of inventory level, however it reduces the profitability. Conversely, under restricted (aggressive) investment policy the firm choose to operate with lower levels of cash, marketable securities, inventories, and receivable. The restricted policy increase the profitability, on the same time it increases the risk, since the probability of cash shortage, and running out of inventory increase. The moderate policy is between the two policies.

According to Besley & Brigham (2008), firm can finance their working capital depending on the level of financing risk it can manage, through three policies, aggressive policy, conservative policy, moderate policy. Through aggressive policy firms choose to heavily rely on short-term

financing. Conversely, under conservative policy, firms use low level of short-term financing. The aggressive policy is riskier than conservative policy, because of the fluctuation in interest rates and possible difficulties in raising desired fund quickly when seasonal peaks take place. While the conservative policy avoid this risk, yet it is more costly.

Whatever is the policy of investment/financing of working capital, the main goal of it, is to maintain an optimal level of all of its components, in order to reduce the risk and increase the profitability of firms, which positively affects firm's value.

Since inventory is an important element of working capital. It forms more than 50% of current assets of manufacturing firms (Ranganatham, 2011). Therefore, efficient management of inventory investment will have significant effect on working capital management. Empirically, Singh (2008) finds that the size of inventory affects the working capital and its management. Moreover, a firm which neglects the management of inventory will have to face serious problems relating to long-term profitability and may fail to survive (Singh, 2008).

The significant role of inventory management is to minimize the costs associated with inventory and increases the benefit of it. In other words firms should determine the size of inventory that makes a trade-off

between the benefit and the costs of holding it. Mathuva (2013) states that the size of optimal level of inventory is determined according to the marginal benefit and the marginal cost of holding it.

Therefore, firms in determining their level of inventory should take into considerations the costs of inventory holdings, customer requirements, and smoothing the production process. According to Michalski (2009) inventory management decision is complex, excess inventories incur high costs (finance, holding, opportunity cost), and decreases the risk of production failures, while holding low inventory level can carry out problems related to meeting supply demands.

There is a conflict relative to the amount of inventory firms wish to hold; holding large amount of inventory will reduce the unit cost of ordering, protect firms against any unpredictable fluctuations in demand that may occur in the future, by meeting their customers demand without trying to adjust their production levels. But at the same time, this will increase the holding costs especially if the inventory does not sell fast. On the contrary, holding insufficient inventory levels lead to lose sales and delay the customer’s orders, which may affect the profitability of the firms.

2.3 Financial Constraints and Inventory Investment

Firms might be exposed to financial constraints either internally or externally. Marouene & Abaoub (2013) state that external finance constraints refer to asymmetric information which reflect difficulty in raising funds externally, while internal finance constraint refer to the level of internal funds that is generated by a firm and is available for use.

Greenaway *et al.* (2007, p 380) define a financially constrained firm in which "it is difficult or too expensive to obtain external finance such as loans, will in fact only invest if it has sufficient internal funds, and will invest more the higher of its cash flow". While, Kaplan & Zingales (1997, p 172) state that firms are classified into financially constrained " if they face a wedge between internal and external cost of funds".

Most of research on asymmetric information shows how information cost in the presence of insufficient internal funds affects the different kinds of investment decisions. It is found that financial constraints play an important role in determining different kinds of firms investment, such as fixed capital, R&D, and inventory investments[1].

1. See Fazzari et al. (1988) , Fazzari and Athey (1987), Fazzari and Peterson (1993), Hubbard (1998), and Chen *et al*.(2009).

Firms hold inventory. ″Inventory is an inevitable consequence of trading in products, it can be in the form of raw materials, work in progress, and finished goods ready for sale″ (Tennent, 2008, p 253). The main purpose of inventory is to allow the operations of the firms to move smoothly. According to Allen & Pollmann (1997) inventories allow firms, First, to supply unexpected demand without having to adjust outputs immediately. When marginal costs of production increase, firms can use their inventories in order to smooth production without attempting to adjust it, as long as, the cost of adjusting production is more than the holding costs of inventories. Second, inventory acts as a buffer stock by absorbing the increase in demand while production remains steady.

Moreover, Tennent (2008, p 253) provides other reasons for holding inventories. First, "to ensure continuous production runs with a complete set of components", which means that inventory can protect against any scarce of supply, which make the production to move steadily. Second, "to purchase quantities that are economic", i.e. ordering large amount of inventories will be less expensive than buying the same quantity in different time. Third, " to provide customer choice".

When businesses hold inventory, they will incur a number of relevant costs. Akcali & Bayindir (2008) state that inventory holding cost is

comprised of two components. First, out-of-pocket cost, which is related to the storage and handling of the products/parts. Second, opportunity cost (cost of capital) that is proportional to the amount of capital tied up in inventory. There are other costs associated with inventory holding such as Management costs, the cost of management time in counting, finding, moving and inspecting (Tennent, 2008). In addition, obsolescence, damage, and Theft costs.

In the recent time, the interest of researchers does not focus only on the impact of financial constraints on fixed investments, but it is extended to include a variety aspects of firms such as inventory investment. Most of research focused on the factors that may affect the level of inventory investment such as financial constraints.

Hornstein (1998, p 49) gives three reasons for the increased attention on the change of the level of inventory investment. First, ″changes in inventory investment apparently account for a substantial fraction of changes in gross domestic product (GDP)″. Second, ″current changes in inventory investment are assumed to convey useful information about the near term future of the economy″. Third, ″there is a view that the inherent dynamics of inventory investment are destabilizing the economy″.

Inventory investment plays an important role in the business cycle. Despite of its small portion relative to the total production, the change in inventory investment during recessions have a significant effect on change of GDP. Yue (2011) states that the decline in inventory investment during recession will affect significantly on the reduction of GDP. Also, Blinder & Maccini (1991), Blinder (1981) show in their research that the decline of inventory investment has accounted for most drop in GNP during the periods of recession.

When firms want to invest in a new investment, they can finance their investment through. First, by using internal funds (accumulative profit). Second, by borrowing either from banks or through the issue of financial assets such as (long-term) bonds or (short-term) commercial paper. Finally, by issuing new shares of stock.

Firms might be subject to financial constraints due to some limitations in raising funds externally, in financial markets, especially in the period of recession, when there are restrictions to access to external financing due to its higher costs[1], which in turn prevent the firm from undertaking all of their profitable investments. Fazzary and Athey (1987) state that in the

1. According to Fazzari et al. (1988) external finance is more costly than internal finance because of: transaction costs, tax advantages, agency costs, costs of financial distress, and asymmetric information.

presence of market imperfection, firms might forego some of their investment if they must be financed externally.

External financing constraints force firms to depend on their internal finance (cash flow) when they decide on the level of the profitable investment they are going to accept. Moreover, firms that have restrictions to access external funds will be more sensitive to internal funds comparing with firms with less financial constraints. Their level of investment will be positively related to their amount of internal funds. Fazzari *et al*. (1988) state that when firms face tight external financial constraints, it will depend on their internal funds. This is supported by Cunha & Paisana (2010) who conclude that firms that face either higher asymmetric information or weak financial situation, demonstrates higher sensitivity to cash flow.

In the presence of market imperfection, declines in internal funds will affect all kinds of investments. The highest effect among these investments will be on inventory investment. Inventory investment has low adjustment costs compared with capital investment, therefore it is used by the firms that suffering from financial constraints to compensate them for financial distress (decline in cash flow). This might force the

firm to decrease its investment in inventory[1]. Empirically, Hubbard (1998) argues that the reduction in inventory investment will be larger than the reduction in fixed capital in response to fall in net worth; this because of the lower adjustment costs of inventories relative the adjustment costs of fixed capital. Also, Carpenter *et al*. (1994) state that since inventory investment has low adjustment costs relative to those of adjusting fixed capital and R&D[2] investment, the decline in inventory investment caused by the contraction of internal funds will be large relatively to fixed investment, which means that firm prefer to reduce its inventory investment when facing shock in internal finance than decline the fixed investment level. So, it is expected to find that the financial constraints have a significant effect on inventory investment.

Moreover, during the period of monetary policy contradiction, firms with poor internal funds will be expected to be more financially constrained than firms with good internal funds. This means that access to external funds during this period seems to be difficult and costly. The reason behind this as explained by Gertler & Gilchrist (1994) is that the tight

1. As Cunningham (2004) state that any decline in cash flow yield to decline in the amount of external borrowing that collateralized by internal funds, forces the firm to reduce its borrowing or pay a premium on its loan. As a result Firm may reduce its inventory rather than decline its capital investment.

2. Shin and Kim (2011) state that adjustment costs for R&D is higher than for physical investment such as fixed asset and inventory investment. Also Himmelberg and Petersen (1994) state that R&D does not react to fluctuations in temporary cash flow due to its higher adjustment cost.

monetary policy had direct, and indirect effects, Gertler & Gilchrist (1993, p 49) state that "the rise in the interest rate reduces the discounted value of collateralizable net worth, thereby raising the premium of external finance". The indirect effect of monetary policy clarified by Gertler & Gilchrist (1994) who state that tight money caused a decline in spending, cash flow, and asset value, which gives rise to balance sheet to deteriorate, and increase the premium charge of external funds.

Moreover, Obembe *et al*. (2012) state that contractionary monetary policy has a negative impact on the balance sheet position which constrain firms from raising funds externally, due to their higher cost. Therefore, Guariglia (1999) states that the effect of financial variables (coverage ratio, cash flow) have a strong effect on inventory investment at financially constrained firms especially during tighten monetary policy.

Inventory investment, like other investments need to be financed, either internally or externally, and it is affected by the ability of the firms to access external funds. Firms that have restrictions to access to external funds because of information costs, might affect their ability to achieve their desired level of inventory. Carpenter *et al*. (1998) find that the fluctuations in internal funds are absorbed through change in inventory

investment for small firms[1]. Moreover, Guariglia & Mateut (2010) argue that financial variable[2] has significant effect on the level of inventory investment for the firms that suffering from financing constraints (small, young, and more risky firms).

Kashyap *et al*. (1994) find that during the period of recession when there is tightening in the monetary policy, inventory investment of firms that couldn't access public debt market (bank-dependent)[3] are significantly liquidity constrained. i.e. firms that have impediment to access external funds, and don't have sufficient internal funds, are going to cut down their inventory investment by more than the firms that are non bank-dependent.

2.4 Inventory Behavior

The motivation behind the economic theory of inventory behavior rise from the reasons of why firms hold inventory[4]. There are several models

1. They used in their research three financial variables (coverage ratio, cash stock, and cash flow). They find that among all financial variables cash flow has the largest effect on inventory, they suggest that 15%-40% of cash flow fluctuations are absorbed by inventory investment for small firms.

2. They introduce the financial variable as a ratio of the firm's short-term debt to the sum of its short-term debt and trade credit, where short-term debt is essentially made up of bank loans, and credit is a form of financing automatically created when customers delay payment of their bills to their suppliers.

3. According to the author bank-dependent refer to the firms have neither bond market access nor large internal cash reserve

4. According to Blinder & Maccini (1991) "inventories can be held for display purposes, as unavoidable "pipeline" inventories, to improve production scheduling, to smooth production in the face of fluctuating sales, to minimize stockout costs, to speculate on or hedge against price movements, to reduce purchasing costs by buying in quantity, to shorten delivery lags, and so on"

that explain inventory behavior which motivates firms to hold inventories. These models are the production smoothing model (PSM), the (S,s) models, and stock out avoidance motive (Benito, 2005).

The basic hypothesis behind the production smoothing model is, firms hold inventories in order to smooth their production when they face fluctuation in demand, and convex cost functions (Eichenbaum,1989). According to Benito (2005) the production smoothing model helps a firm to sustain its cost production when the marginal cost of production rise and demand fluctuate over the time. Moreover, Hornstein (1998) states, if firm's sales are changing and its marginal cost remain constant, then firms minimize costs by smoothing productions, and it declines (increase) its inventory whenever sales more than (less than) productions. This indicates that sales and inventory investment are negatively related. Moreover, inventory act as a buffer-stock by absorbing any fluctuation in demand.

According to Iturriage (2000), in order to be in line with production smoothing model, sales must be more volatile than production (using inventory to sustain the production process), sales and inventory investment are negatively related. Moreover, as Allen (1997) states, if

inventory are used as a buffer stock, then inventory and sales are negatively related.

Few studies met the production smoothing-buffer stock model requirements, while most of studies contradict it, finding that the variance of production is greater than the variance of sales, indicates that the production is more volatile than sales[1]. Also, empirical studies find that sales and inventory investment are positively related.

Moreover, Eichenbaum (1989) aims to examine the plausibility of the production level and production-cost smoothing models of inventories. He finds strong evidence against the former and weak evidence against the later; he concludes that productions are more volatile than sales, because inventory allows firms to increase (decrease) their productions in the period in which production costs are relatively low (high).

The (S,s) model assumes a steady distribution of the inventories over the period (S,s); it does not take the sales and the previous inventory levels into consideration (Iturriage, 2000). In this model a firm determines its lower limit of inventory as "s" in which it will not allow its inventory to go beyond it. Whenever its level of inventory hits this point, it places an order large enough to return its inventory to its upper limit, S (Blinder &

1. See for example: Eichenbaum (1989) ; Blinder & Maccini (1991) ; Blanchard (1983) ; Kahn (1987) ; Kahn (1992) ; Allen & Pollmann (1997).

Maccini, 1991)[1]. Large order of inventory decreases the unit-cost of order[2], while in the same time firms will forego additional interest on income which is used in financing the large order. So, it needs to make a trade-off between the two costs. Moreover, Kahn (1992) states that stock out avoidance motive suggests that inventories help firms to avoid any short of stock, which might impose costs on firms due to loss of its sales.

According to Sangalli (2013), there are several models used to determine the short-run variability of inventories: target adjustment models (lovell, 1961), production smoothing models (Blinder and Maccini, 1991), and production-cost smoothing models (Eichenbaum, 1989). More specifically, target adjustment models are set to explain the returning of firms inventory toward the optimal level (target level). This model will be used in this study in order to determine whether Jordanian firms have optimal level of inventory, and how fast they move toward it when any deviation exists.

2.5 Determinants of Inventory Investment

According to Mathuva (2013) the most important determinants of inventory investment are:

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1. Blinder & Maccini (1991) state that firms use this model when it has neither optimal level of inventory nor speed of adjustment, it has optimal range whenever its inventory hit the lower limit point it adjusts it to the upper limit, otherwise it will not.

2. According to Blinder & Maccini (1991) marginal cost of ordering is constant(fixed cost).

1. **Ability to generate internal resources**: The imperfection of capital market raises the external finance cost. As a result, firms follow picking order theory in financing their investments, beginning with internal funds (cash flow). Internal funds have a significant effect on investment including inventory investment. Carpenter *et al*. (1994) show that the fluctuations in internal funds have an impact on all components of investments, as a result of negative shock of internal funds, financially constraint firms will reduce their accumulation of all assets, because of low adjustment costs of inventory investment, its decline will be the large relative to fixed investment. Moreover, they conclude that cash flow has a significant positive impact on inventory investment for both small, and large firms, but it seemed to be stronger for small firms. Tsoukalas (2006) finds that small firms are more response to cash flow shock than large firms. Which means that the effect of cash flow on inventory investment is more concentrated through firms that are financially constraints.
2. **Volatility in expected sales:** sales has a significant effect on inventory investment, if sales in a given period seemed to be higher than expected, then the level of inventory investment for that period will be lower than anticipated. Gaur *et al*. (2005) find that

sales are negatively related to inventory investment. Moreover, Mathuva (2014) finds that unexpected sales have a negative effect on inventory investment, implies that, an increasing in sales lead to reduction in inventory investment.

3. **Firm size:** Most of empirical research use the size of the firm as a proxy to split it into financially constraints/un-constraints (Cunningham, 2004 ; Guariglia, 2008 ; Azam and Shah, 2011). Firm size has a positive effect on inventory investment, small firms are likely to be more financially constraints than large firms, because large firms have a wider access to external finance than others. Guarigilia & Mateut (2010) find that inventory investment of smaller firms is more sensitive to financial variable than large firms. Moreover, Tosukalas (2004) finds that inventory investment is more sensitive to cash flow for smaller firms relative to large firms.
4. **Leverage:** According to Ramadan (2012), the leverage ratio that is widely used, is the one that includes the short-term debt, long-term debt, tangible asset and intangible assets. It can be calculated by adding the long and the short term debt and dividing it by total assets (tangible + intangible). Leverage ratio is an indicator to what extent the firm depends on external finance in financing its

investment. Ramadan (2012) states that as this ratio increases, the ability of the firm access external funds decline. As a result, a firm with high leverage ratio will be in financially constraints if it doesn't have sufficient internal funds. Therefore, financing inventory through debt may be costly relative to internal finance. There is a mix in the relationship between inventory investment and the leverage ratio, some studies show that they are negatively related, while others find they are positively related (Mathuva, 2013).

5. **Liquidity:** Lopez (2008, p 1) defines the liquidity as "the ability of a financial firm to meet its debt obligations without incurring unacceptably large losses". Liquidity level affects the level of inventory investment. Kashyap *et al.* (1994) find that the inventory investment of firms without neither access to external funds (public debt market) nor have large internal funds are significantly liquidity constrained, especially during recessionary period. On the contrary, Mathuva (2013) and Obembe *et al*. (2012) find that liquidity has no significant impact on the level of inventory investment.

6. **Age:** Most research uses the age of the firm as a proxy to classify firms into financially constraints and financially un-constraints

(Guariglia & Mateut (2010), Cunha & Paisana (2011), and Cunningham (2004)). Information asymmetric has a greater effect on young firms, due to the little public information available for them. Therefore, Hartarska & Gonzalez-Vega (2006) state that young firms are more constrained to the amount of internal funds, and likely to face higher information costs for external funds. Since the age of the firm restricts the accessing to external funds, the inventory investment is likely to positively related to firm age. Guariglia & Mateut (2010) find that younger firms show higher sensitivities of inventory investment to financial variable.

7. **Length of cash flow conversion cycle:** Mathuva (2013) states that the studies present mixed finding associated to the relationship between cash flow conversion cycle and inventory investment. He finds that firms with longer conversion cycles have higher inventory investment.

Chapter Three

Literature Review

3.1 Introduction

Financial constraints have attracted the attention of many researchers around the world through investigating their effects on various aspects of firms. They focus not only on the effect of financial constraints on capital investment, but they extend their interest to study the effect of financial constraints on other aspects of firms, such as inventory investment, R&D and so on.

There are several empirical studies around the world that indicate the existence of financial constraints, which affect the ability of firms to raise funds externally. See for example (Fazzari & Athey, 1987 ; Whited, 1992 ; Kashyap *et al.*,1994 ; Carpenter *et al.*, 1995 ; Vermeulen, 2002).

Inventory is an important element of current assets, because it provides firms with stable production process, and enables the firms to meet any increase in demand, without losing sales or increasing the level of production. As discussed previously, when the firm decides on the level

of inventory, it should take into consideration the benefit and the cost of inventory.

Several empirical studies around the world focused on the relationship between inventory investment and financial constraints, and try to explain this relationship. They identified a number of financial variables that might affect the level of inventory investment. Moreover, they aim to predict the adjustment speed of inventory toward the optimal level.

Most of the studies on inventory investment and financial constraints find that the financial constraints have an impact on inventory investment. Firms may be exposed to financial constraints during a period of insufficient internal funds, with difficulties in accessing capital markets. On the contrary, other studies do not find any evidence of the effect of financial constraints on inventory investment.

3.2 Empirical Studies

Carpenter *et al.* (1994) show that the fluctuations in internal funds (cash flow) can be absorbed through adjustments of inventory, since it is liquid assets with low adjustment costs. In their study, they use quarterly data of U.S. manufacturing firms during the period (1981-1992), which

contains swings in inventory investment, and a large fluctuation in internal funds, with a troughs in 1982,1986, and 1991. This study aims to examine whether fluctuation in internal funds (cash flow) have any impact on inventory investment. They use inventory investment model augmented by a cash flow variable (as a measures of internal funds). Splitting the sample by firm size, they find that swings in cash flow (internal finance) has an impact on inventory investment for both small and large firms, but it seems to be stronger on small firms[1]. This result in line with the financial-constraints hypothesis: "for any given fluctuation in internal funds, small firms should exhibit a greater inventory response".

Kashyap *et al.* (1994) examine micro data on manufacturing firms' inventory behavior in US, during different macroeconomic episode. The study uses quarterly data over the period (1974-1989), it focuses on the recessionary episode, during the period 1981-1982 & 1974-1975. Since liquidity is important for the inventory behavior, authors use liquidity ratio (LIQ) (defined as ratio of cash and marketable security to total

1. Same result is obtained when splitting firms relative to bond rating (firms with bond rating/firms without bond rating)

assets), and "bond market access dummy" in the regression. The main finding is that, inventory investment of firms without access to public capital markets, is significantly liquidity-constrained during the recessionary episode, which means that the bank dependent firms-in case of having neither sufficient internal funds nor bond market access- are likely to reduce their inventory level during this period, by more than nonbank-dependent counterparts.

Carpenter *et al*. (1995) aim in their study to examine the three financing constraint hypothesis[1], and employ them to examine inventory fluctuations over the period (1981-1992). They use a standard inventory stock adjustment equation augmented with financial variables to capture the effect of financial constraints. The financial variables include cash flow (internal finance), the stock of cash (bank lending), and interest coverage ratio (collateral). They find that, "The internal finance hypothesis[2], however, appears to be the most general in the sense that it explains more dimensions of heterogeneity in the data, and it appears to

1. The collateral hypothesis, the bank lending hypothesis, and the internal finance hypotheses

2. According to authors internal finance hypothesis required no debt mechanism. An additional dollar of cash flow permit the firm to invest an additional dollar, even though if external finance is unavailable or costly.

be capable of explaining the greatest proportion of inventory fluctuations over the business cycle".

Zakrajsek (1997) investigates the effect of internal funds on inventory levels. The data had been collected for 782 US retail trades firms over the period (1977:Q1-1991:Q3). The empirical results show that internal funds are significant indicators of the level of inventory when firms have restrictions in accessing the capital markets. Moreover, he finds that fluctuations in internal funds, produce a large portion of the fluctuations in aggregate retail inventory.

Carpenter *et al.* (1998) find that the financial variables (stock of cash, coverage ratio, cash flow) have some significant effect on inventory investment. It is found that cash flow has stronger effect on inventory investment comparing with stock of cash, coverage ratio. Moreover, inventory investment at small firms is more sensitive to cash flow. The study uses a panel of quarterly data for U.S. manufacturing firms over two period: period 1 runs from (1982.3-1984.1), period 2 from (1984.2-1988.3).

Moreover, **Guariglia (1999)** investigates the impact of internal finance on inventory investment during recession, and expanding period, by using annual data for 994 UK manufacturing firms. The data covers the period from (1968-1991). The study uses a variant of Lovell's target adjustment model (1961), and augmented with coverage ratio, and cash flow separately. Different than other studies, this study uses coverage ratio, net leverage ratio, and short-term debt-to-sales ratio to identify financially constrained firms. Finding from research indicates that the financial variables (coverage ratio[1], and cash flow) have a strong effect on inventory investment at financially constrained firms, especially during recession period. This effect is more stronger at work-in process, and raw material than for total inventory[2]. Also, the effect of financial variables on healthy firms, has no significant impact on inventory investment, across stages of business cycle.

Guariglia (2000) finds that financial constraints have a stronger impact on inventory decisions at firms with poor balance sheet (either low

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1. According to authors the coverage ratio is defined as the ratio of pre-tax and pre-interest earnings to total long and short-term interest payments. Which can be thought of as a proxy for the premium that firms have to pay for external finance

2. The result indicated that work-in-process and raw material inventories, represent on average 24% and 32% respectively of total inventories.

coverage ratio or high short-term debt to inventories ratio), than of firm with stronger balance sheet. The research is applied on UK manufacturing firms over the period (1980-1991) to study the effect of capital market imperfection on financially constrained/un-constrained firms. Short-term debt to inventories (coverage ratio) has been used as a proxy to categorize firms into financially constrained/un-constrained.

Further evidence on the effect of cash flow on inventory investment is conducted by **Small (2000)** who used a panel of 527 UK manufacturing firms during the period (1977-1994). The finding indicates that the sensitivity of inventory investment to cash flow at financially constrained firms, is more than of that at financially unconstrained firms.

In another study using a panel data for 82 Dutch firms, **Bo *et al.* (2002)** aim in their study to illustrate the relevance of capital market imperfection in explaining the inventory investment of Dutch firms, during the period (1984-1995). They use Lovell target adjustment model (1961), amended it with cash flow to introduce the capital market imperfection. The study uses three proxies for financial constraints: size (small/large), dividend payout (high/low), and indebted (high/low) (split

firms by calculating the ratio of debt to capital stock). The result of the study indicates that, inventory investment of financially constrained firms are more sensitive to cash flow shock than unconstrained firms (which support the relevance of capital market imperfection in explaining Dutch inventory investment). Moreover, in contrast to other studies on inventory investment[1], this study revealed that cash flow did not have any significant impact on large Dutch firms, but only on small firms[2]. Also, the result suggests that augmenting the Lovell model with proxies for capital market imperfection is important to get both accurate result, and accurate speed of adjustment.

In another study applied on a developing country, India, **Saggar (2003)** examines the behavior of inventory investment which include raw material, work-in process, finished good and total inventory. The study uses annual data of 1800 Indian firms during the period (1971-1972) and (1999-2000). The study uses stock adjustment inventory model based on Lovell (1961) model. This model is augmented with cash flow, price

1. This result was inconsistent with Carpenter et al. (1994), who found that cash flow had an impact on inventory investment for both large and small firms, but stronger at small firms.

2. The author refer this to the fact that Dutch firms are multinational firms

expectation, and interest rate. The result of the study indicates that cash flow still has significant impact on inventory investment, which means that external financing premium still exists in spite of the different ways of financing that are available for firms from the capital market or elsewhere. Availability of internal funds cause fluctuation in inventory investment.

Bagliano & Sembenelli (2004) investigate the impact of recessionary episode on inventory investment at three countries: France, Italy, and UK. The study covers 6000 firms during the recession of the early 1990s. The data set is extracted from an annual balance sheet, which started in 1989 for France and the UK, and in 1991 for Italy, the end of the sample is 1997 for all countries. Three measures of financial pressures are used: leverage ratio, short-term leverage, and debt maturity[1]. Two proxies are used to split firms relative to their difficulties in accessing capital market: size, and age. The result indicates that in all three countries, during a period of recessionary, firms reduce their level of inventory significantly beyond the level that is determined by cyclical behavior of

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1. 'leverage' is computed as the ratio of total debt (short- and long-term) to total liabilities (debt and shareholders' funds); 'short-term leverage' is computed as the ratio of short-term debt to total liabilities; 'debt maturity' is computed as the ratio of short-term debt to total debt.

sales. Moreover, significant and negative relationship is found between inventory levels and the level of leverage. This suggests that all firms respond to the financial pressures by lowering their level of inventory. Indicating that the financial pressures have a negative impact on inventory investment.

Benito (2005) uses a large company-level panel data-set for two countries UK, and Spain[1], to predict the adjustment of inventory investment for both countries, by determining the effect of financial pressure, and monetary policy on inventory investment, during the period (1973–2000). The study uses the following financial variables as a measure of financial pressure, borrowing ratio (ratio of debt interest payment to cash flow), liquidity, debt, and cash flow term[2]. He finds that the speed of adjustment to the long-run equilibrium for UK firms is faster than Spain firms, due to the lower costs in accessing the capital markets for UK firms than Spain. Also, he finds that the borrowing costs have a

1. According to authors the main difference between the two country is the "more advanced financial markets in the United Kingdom and the lower costs of access to public markets for UK firms than in Spain, where companies are more likely to obtain funds through intermediaries, in particular through banks". Which means that the financial systems in UK is market-based, while in Spain is bank-based

2. Cash flow (CF). is defined as the profit after tax and preference dividends plus depreciation of fixed assets. Liquid assets are given by cash and equivalent, normalized on capital stock measured at replacement cost. Debt is obtained by total loan capital plus borrowing repayable in less than one year divided by replacement cost of capital stock. Net debt subtracts cash and equivalent from the Debt

significant impact on inventory investment. Moreover, he concludes that the financial effects related to the liquidity and borrowing ratio are stronger in UK than Spain. However, the financial system in Spain is bank-based, while in UK it is market-based, which contrasts the Bank Dependence Hypothesis.

In another study **Tsoukalas (2006)** uses another type of test to predict the influence of internal funds (cash flow) on inventory investment for US manufacturing sector during the period (1975:1 to 1995:4). He finds that inventory investment at small firms is more sensitive to the shocks of cash flow than at large firms.

Benito & Hernando (2007) examine the responsiveness of various aspects of Spain firms (fixed investment, employment, inventories, and dividends) to financial pressure. Their study covered the period of (1985-2000). They find that financial pressure has a significant effect on fixed investment, employment, inventories, and dividends. Moreover, they find that the borrowing ratio has a significant negative effect on inventory investment, means that firms respond to financial pressure by

significantly changing their level of inventory, especially when there is an increasing in borrowing costs.

Guariglia & Mateut (2010) aim to analyze the impact of firms' financial health on inventory investment on the context of global engagement by using 9381 UK firms, over the period (1993-2003). Lovell's target adjustment model (1961) is used, and it is augmented with the financial variable (MIX[1]), as a measure of the strength of the financial constraints. They conclude that inventory investment at financially constraints firms (smaller, younger, more risky, and firms that are not globally engaged) show higher sensitivities to financial variable.

Cunha & Paisana (2011) collect data from Portuguese manufacturing firms over the period (1990-2000) to identify inventory investment-financing constraints relationship. They use Lovell's model (1961) and augment it with three financial variables: Cash flow, Stock of liquid assets, interest-bearing short-term liabilities[2]. They find that inventory

1. MIX is defined as the ratio of the firm's short-term debt to the sum of its short-term debt and trade credit.

2. According to author cash flow is defined to the sum of profits and depreciation allowances. Stock of liquid assets given by the sum of cash flow, deposits, and marketable securities. lagged liquid assets (LA), and lagged short-term debt (STD) are two variables used to reflect the balance sheet effect on investment decisions. LA reflects the fact that firms can use their accumulated stock of cash to finance the acquisition of inventories, while STD reflects the impact of leverage on the decisions of firms

investment of firm with a weak balance sheet (as measured by the interest coverage ratio) is more dependent on the availability of cash flow than of financially healthier firms. This means that firms with higher financial constraints depend more on their internal funds to finance their inventory investment, and these financial constraints have an impact on inventory investment decision. Moreover, they also find that a firm's size doesn't change the impact of cash flow on inventory investment, younger firms are more sensitive to internal funds, and cash flows have an impact only on investment of poor financially situation during recession and economic expansion.

On the contrary, in another study on emerging market, Nigeria, **Obembe *et al.* (2012)** use 76 quoted firms in Nigerian stock exchange over the period (1997–2007) to study the effect of financial constraints on inventory investment for Nigerian firms. The study follows Lovell's target adjustment model (1961) which is augmented with liquidity ratio, borrowing ratio, cash flow, and bank debt ratio. They find that the financial constraints have no significant impact on inventory investment in Nigerian firms. Moreover, they find that "asymmetric information

between borrowers and lenders may have little or no effect in the credit market in Nigeria".

In his attempt to assess whether the financial constraints is suitable to explain the short-run deviations of inventory investment from its long-path, **Sangalli (2013)** uses in his paper three large unbalanced panels of Italian manufacturing firms over the period (1991-2009). This period include two severe recessionary period: the early nineteenth recession and the 2009 shock. Lovell's target adjustment model (1961) is used, and it is augmented with financial variables (Fin) as a proxy for financial pressure; he uses three measures for it *(* leverage ratio, short term debt, and debt maturity)[1]. Moreover, three measures are used as a proxy to classify firm as risky firm: coverage ratio, acid test ratio, and CEBI rating[2]. The result indicates that the financial frictions have a negative impact on inventory investment behavior, and consequently, affect the

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1. According to author leverage ratio is defined as a ratio of short and long term- debt to total debt, including debt and share holders' funds. Debt maturity is defined as the ratio short- term debt to total debt

2. Coverage ratio is calculated as the ratio of the interests paid on debt to EBITDA (earnings before interests, taxes, depreciation and amortization) and measures the capability of a firm to cover its interest-related expenses. 'acid test ratio' is defined as the ratio of current assets, net of inventories, to current liabilities and determines whether a firm has enough short-term assets to cover its immediate liabilities without selling inventories. CEBI rating is an assessment of the credit worthiness of corporations calculated periodically by the main collector of firms' balance sheets in Italy (Centrale dei Bilanci), on the basis of both economic and financial characteristics of firms under scrutiny.

target level of inventory. No effect has been found during recessionary peaks.

3.3 The Predicted Adjustment Speed Toward the Target Level.

The speed of adjustment towards the target level takes the amount between 0 and 1. As it is close to 1, the firms immediately adjust their inventory level toward the target.

Few of empirical studies predict the speed of adjustment toward the target level. Carpenter *et al*. (1994) on U.S. manufacturing firms estimate the adjustment speed between 13%-30% a quarter, this adjustment speed has been calculated to total inventory (raw material, work-in process, and finished goods). While, Bo *et al*. (2002) in their research on Dutch manufacturing firms estimate the speed of adjustment to be 0.398. Saggar (2003) estimates the speed of adjustment on Indian firms between 30%-46% per annum in the three sub-period, and 26% for the full period. Obembe *et al*. (2012) find that the speed of adjustment for Nigerian firms is 47 percent. Mathuva (2013) on his research on developing country finds that the speed of adjustment for Nairobi firms during the period

(1996-2008) is 48% which means that firms do not adjust to their target inventory investment level immediately.

3.4 Study Contribution

Previous studies presented above, discuss the effect of financial constraints on inventory investment, which focus on firms in developed countries all around the world. The literature does not provide considerable research on financial constraints and inventory investment in developing countries. As well as, few of them focus on the optimal level of inventory, and the speed of adjustment towards it.

To best of the researcher knowledge, in Jordan, this study is the first one that investigating the relationship between financial constraints and inventory investment, and determining whether Jordanian industrial firms have a target level of inventory, and how fast they move toward it.

Therefore, this study contributes to the literature by providing another evidence on the relationship between inventory investment and financial constraints, and in determining whether Jordanian firms have an optimal level of inventory, and how fast they move toward it when any deviation exists.

The current study will be integral to what has been written so far; it covers the period (2001-2011). This period includes the recent global financial crises, and a high recession episode in Jordanian economy with high levels of inflation rates, which has an impact on different kinds of investment including inventory investment.

Chapter Four

Research Methodology

4.1 Introduction

This study aims at: First, investigating whether Jordanian industrial firms listed on Amman Stock Exchange over the period (2001-2011) have a target level of inventory, and how fast they move toward it if any deviations exist. Second, investigating whether the financial constraints have an impact on inventory investment of these firms. This chapter provides information about the data collection methods, sample and sample selection criteria, models, variables and their measurement.

4.2 Data Collection

The study uses pooled and panel data analysis. The data is extracted from firms' annual reports which are publicized on ASE website. It covered the period from (2001-2011) on an annual basis.

4.3 Sample of the Study

The population of the study consists of all industrial (manufacturing) firms listed on ASE, during the period (2001-2011). The reason behind using the manufacturing firms in the study is the presence of inventory

item in their balance sheet. The total number of industrial firms listed on ASE at the end of 2011 is 76 firms.

Firms to be included in the sample of the study must meet the following selection criteria:

1. All firms with missing data over the study period are excluded.
2. All firms that have stopped their operations or have been liquidated during the period of study are excluded.

After applying these criteria, the final sample is reduced to (50) industrial firms, and data on variables is collected from the annual report of these firms that are publicized on ASE website. (Appendix (1) shows the names of Jordanian firms included in the study).

The period of the study (2001-2011) is distinguished by the entrance of Jordan into the free market economy. Moreover, this period includes the global crisis which had a negative impact on Jordanian economy, producing more contradiction in the monetary policy, which may impose a negative reaction on inventory investment by reducing its level beyond the target level. Also, this period is marked by higher levels of inflation, which may increase the probability of recessions, and negatively affect inventory investment.

4.4 Empirical Model Specification

The empirical model that will be used in this study depends on Lovell's target adjustment model (1961)[1]. Lovell (1961, pp295) indicates that, "entrepreneurs are assumed to make only partial adjustment of stocks to the equilibrium level each period". The reasons behind this as stated by Lovell (1961) is due to the heterogeneity nature of stocks, and due to the fact that each term of inventories is ordered in infrequent interval. Other reason that makes firms to partially adjust toward the target is the cost associated with the immediate adjustment. Yue (2011) states that ordering in small amounts and fast delivery requires premium cost, which increases the cost of purchasing.

Moreover, Sangalli (2013) states that the reason behind the selected model is that firms intend to hold inventory relative to sales in the long run (target level of inventory), and adjust it relatively to such a desired level in the short-run.

So, this model indicates that each firm has a desired target level of inventory- which is a linear function of excepted sales - it would like to maintain, and if actual inventory deviates from the desired one, firms make partial adjustment toward the target level. According to Yue

1 This model is used by several studies like (Guariglia & Mateut, 2010 ; Cunha, Paisana, 2011 ; Guariglia, 1999 ; and Cunningham, 2004)

(2011), it is difficult for firms to maintain their inventory investment at desired level because of sales shock and forecasting errors. Therefore, firms will follow partial adjustment procedure in adjusting their inventory towards the optimal level. Based on these ideas, partial target-adjustment model seems to be the most suitable model to be used in this study.

Most previous studies use the same model, and augmented it by several financial variables, as proxies for the financial position of the firms, and as measures of internal funds, which are different from one study to another.

Therefore, to determine the relationship between the financial constraints and inventory investment this study will build a model based on the Lovell's target adjustment model (1961), and augment it with two financial variables as a proxy for the financial position of firms. These financial variables are: cash flow (CF), and leverage ratio (LVR). The justifications of using these variables will be discussed later.

Following Braun (1981), Blinder & Maccinia (1991), Bechter & Stanely (1992), Carpenter *et al*. (1998), and Bo *et al*. (2002) the study will employ the widely used inventory investment model:

$$\Delta I_{it}=\lambda(I^{*}_{it}-I_{i,t-1})-\kappa(S_{it}-ES_{it}) \qquad (1)$$

Where:

I^{*}_{it}, $I_{i,t-1}$ represents the target level of inventory in the period t and the actual level of inventory at the end of previous period respectively. S_{it}, ES_{it} represents the actual and the expected sales in period t respectively. λ represents the speed of adjustment. $0< \lambda<1$. κ measures the extent to which inventory serve as a buffer stock against unexpected changes in sales (Bechter & Stanely, 1992).

According to Guariglia & Mateut (2010), target inventory in period t (I^{*}_{it}) depends on the volume of sales in that period. (see also Carpenter *et al*. (1998), Bechter & Stanely (1992), Braun (1981), Carpenter *et al*. (1994))

$I^{*}_{it}=a+b\, S_{it}$ ……………………..(2)

b is the marginal desired stock, it can be considered as an accelerator effect: if sales are anticipated to increase, then target stock of inventories will also increase (Guariglia & Mateut (2010)). However, expected sales in period t are not perfectly known in previous periods, so actual sales in previous period can be used (see Bechter & Stanely, 1992 ; Iturriage, 2000)

$ES_{it} = S_{i,t-1}$………………………………….(3)

Substituting 3into 1 yield the following model:

$\Delta I_{it}=\lambda(I^*_{it}-I_{i,t-1})-\kappa(S_{it}- S_{i,t-1})$

$\Delta I_{it}=\lambda(I^*_{it}-I_{i,t-1})-\kappa(\Delta S_{it})$………………………..(4)

Model (4) will be augmented by two financial variables (lagged cash flow and lagged leverage ratio) as a proxy for the financial position of the firms, and by denoting $I^*_{it}-I_{i,t-1}$ by TD_{it} therefore model (4) can be written as follow to be the first model in the study.

$$\Delta I_{it}=\alpha_0+\alpha_1 TD_{it}-\alpha_2\Delta S_{it}+\alpha_3 CF_{i,t-1}+\alpha_4 LVR_{i,t-1}+\nu_i+\nu_{jt}+\nu_t+e_{it} \quad \textbf{(4.1)}$$

In order to determine whether being financially constrained has an impact on inventory investment, especially on the target level and on the speed of adjustment toward the target, firms are classified into two groups: financially constrained, and financially unconstrained.

Empirical studies categorized firms into financially constrained/unconstrained relatively to their high or low information costs. Information costs rise as a reaction to the level of information asymmetry between firms and outsiders. The proxy used in this classification is based on: size, age, and risk (Guariglia & Mateut, 2010; Cunha & Paisans, 2011 ; Cunningham, 2004).

This research uses firm's size in order to split firms into financially constraints and financially unconstraints. Several studies have

determined the size as a measure of financial constraints (Carpenter *et al*., 1994 ; Himmelberg & Peterson, 1994 ; Gertler & Gilchrist, 1994 ; Cunningham, 2004 ; Tsoukalas, 2004 ; Guariglia, 2008 ; Azam & Shah, 2011 ; Czarnitzki & Hottenrott, 2011 ; Fee *et al*., 2009 ; Almeida & Campello, 2010 ; Kasseeah, 2012).

Small firms are considered to be more financially constrained than large firms. These firms may incur higher costs in accessing the external funds. There are several reasons to believe in that. According to Carpenter *et al*. (1994), these reasons are: First, small firms have low public information, which in turn increases asymmetric information. Second, small firms rely on bank debt, and they rarely issue corporate bonds or commercial paper.

Hovakimian & Titman (2006) present other reasons that explain why small firms are likely to be more financially constrained. First, empirical research shows that transaction cost declines with issue size, which in turn makes the external funds for small firms to be more expensive than large. Second, small firms have more restrictions in obtaining funds externally because of adverse selection problem. Third, it is easy for large firms to obtain debt, because they are more diversified and they might have less probability of bankruptcy.

Cunha & Paisana (2011), add other reasons which support that small firms are more financially constrained. First, large firms have an easier access to capital market; they use their assets as a collateral. Second, larger firms have more sources of funding than smaller firms, which allow them to reduce the financing risk.

Following Cunningham (2004), Small firms are classified as those that have total asset values of less than the median of total assets in period t, firms that have total asset values greater than or equal to the median are considered to be large. According to this classification, the firm may be classified as small in one period and large in another. So, it is allowed for firms to move between size classes.

To investigate the impact of financial constraints on inventory investment, the study uses a dummy variable (D_{it}) which is equal to 1 if firm i is financially un-constrained, and equal to 0 otherwise. Model (4.1) can be rewrite as follows to be the model of study:

$$\Delta I_{it}=\alpha_0+\alpha_1 TD_{it}+\alpha_2 D_{it}+\alpha_3(D_{it}*TD_{it})-\alpha_4\Delta S_{it}+\alpha_5 CF_{i,t-1}+\alpha_6 LVR_{i,t-1}+\nu_i+\nu_{jt}+\nu_t+e_{it} \quad \textbf{(4.2)}$$

Where:

- **i,j** refer to firms and industries respectively.
- **t** refer to time, t=2001-2011.

- **ΔI_{it} (**dependent variable) represents the fraction of inventory investment required to adjust the stock of inventories to equilibrium level.
- **TD_{it}** (I^{*}_{it}-$I_{i,t-1}$) represents the difference between the target and the actual inventory and is used to measure how far the actual inventory deviates from the target one.
- **ΔS_{it} (S_{it}-$S_{i,t-1}$**) represents the difference between current and lagged sales. Sales are measured by firm's total sales (as defined by Guariglia & Mateut, 2010 ; Cunha & Paisana, 2011 ; Yue, 2011).
- **CF** represents Cash Flow (Operating Cash Flow).
- **LVR** represents Leverage ratio, measured by Total Liabilities/Total Assets (as defined by Yue, 2011). Mathuva (2013) defines the leverage ratio as (short-term debt + long-term debt) divided by total assets.
- **v_i, v_{jt}, and v_t** are included to control firm specific-effects, industry-time specific effects, and time specific effect respectively.
- e_{it} refer to idiosyncratic components.

α_1 measures the speed of adjustment toward the target level. α_5, α_6 capture the effect of lagged cash flow, and lagged leverage ratio on inventory investment respectively.

4.5 Hypothesis Development

Cash Flow (CF)

Cash flow is considered to be the most popular measure of internal finance. It has been widely used by empirical studies that focus on financial constraints and firms behaviors. Firm's investments are sensitive to the level of internal funds available for it. Fazzari *et al.* (1988) shows that because of the imperfection of the capital market, the level of a firm's investment that suffers from financial constraints can vary depending on their availability of internal funds. Because of low adjustment cost of inventory, it will be more affected by the decline of cash flows. Most of the empirical studies find that cash flow has a significant effect on inventory investment. Carpenter *et al*. (1998) find that cash flow has a stronger impact on inventory investment compared with stock of cash[1], and coverage ratio. They also, find that inventory investment at small firms is more sensitive to cash flow. Moreover, Small (2000) finds that the impact of cash flow has more effect on firms that are identified as financially constrained on the basis of either their financial policy or their current ratio. Carpenter *et al*. (1994) find that fluctuations in cash flow (internal finance) has an impact on inventory

1 According to authors the stock of cash is defined as cash and short-term investment

investment for both small and large firms, but it seems to be stronger on small firms. Based on previous studies, this study hypothesizes that cash flow has significant effect on inventory investment.

H_1: *Cash flow has a significant positive impact on inventory investment.*

Leverage

Leverage represents the amount of debt that firms use in financing their investment. It is calculated as a ratio of total debt to total asset. This ratio indicates what extent the firm relies on outside financing (debt) to finance their assets. According to Ramadan (2012), as this ratio increases, the financial risk increases, which in turn decreases the ability of the firm to borrow. This might constrain firms from raising funds externally, and reduce the level of investment firms which are willing to accept. Because of low adjustment cost of inventory, it will be more affected.

The relationship between the leverage ratio and inventory investment is mixed. Sangalli, (2013) and Bagliano & Sembenelli, (2004) find a negative relationship between leverage ratio and inventory investment, while Mathuva (2013), finds insignificant impact of leverage on inventory investment. So, the relationship between inventory investment and the leverage is unanticipated.

H_{01}: *There is a relationship between leverage and inventory investment.*

Small firms face higher asymmetric information problem than large firms, as a result the external finance for small firms requires a premium cost relative to large firms. Since inventory investment has lower adjustment cost compared with capital and R&D investment, it will be more affected, and firms will reduce its level of inventory beyond the target level in order to absorb insufficient internal funds.

H_2: *The financial constraints have a significant impact on inventory investment.*

Target Inventory (TD)

Firms partially adjust their levels of inventory toward their optimal level when any deviation exists. The speed of adjustment toward the optimal level might depend on the ability of firms to raise funds externally or internally.

In this study, α_1 is used to capture a firm's ability to adjust to its target level of inventory and as indication of the speed of adjustment. If α_1=1, this means that the firm exhibits a perfect adjustment to the target inventory investment; if α_1=0, this means that the firm does not have a target inventory investment at all (Mathuva (2013). The perfect

adjustment (immediate adjustment) is possible only in frictionless perfect capital market, when there is no adjustment cost at all. On the other hand, when α_1=0, this implies that the firm faces high adjustment costs which prevent it from adjusting toward the target level because of facing a situation of financial constraints.

H_{02}: *Jordanian firms have a target inventory investment.*

In order to investigate whether the financial constraints affect Jordanian industry firms in their adjustment toward the target level, the previous model will be augmented by the dummy variable D_{it}. In the presence of market imperfection, the financing constrained firms face some restriction which prevent them from raising funds externally. This in turn, affects the ability of the firms to move toward their target inventory, by consuming more time than others. Therefore, it is expected to find that the financially constrained firms move slower than financially unconstrained.

H_3: *Financially constrained firms move slower than financially unconstrained toward the target level.*

Chapter Five

Data Analysis

5.1 Introduction

This chapter aims at analyzing the estimation results of the empirical model used in the study, by using the pooled and panel data analysis, which can be estimated using the Fixed Effect Model (FEM) and the Random Effect Model (REM). Therefore, it presents the descriptive statistics of variables used in the study, as well as the estimation results of the empirical model.

5.2 Descriptive Statistics

This section provides descriptive statistics of the variables used in the study, which include the mean value, standard deviation, the minimum and maximum for each variable. The results of descriptive statistics are reported in Table (5.1). The results show the following:

Table (5.1)

Summary of Descriptive Statistics for Key Variables in the Model (4.2)

Variable	Observation	Mean	Std. Dev	Min	Max
Inv.	549	6.3*	11.1*	0.021*	130*
S	550	30.9*	88.7*	0.031*	847*
LEV	527	0.312	0.203	0.001	0.859
CF	550	0.047	0.120	-.349	0.615
SZ	550	16.478	1.408	13.221	20.925

S represents sales, **Inv** represents inventory, **LEV** represents leverage ratio, **CF** represents cash flow, **SZ** represents the firm size. * denotes these numbers in million.

- The mean value of inventory is founded to be 6.3 with standard deviation, estimated to be 11.1, and minimum value equal to 0.021, while the maximum value is 130, which indicates that there is a high variety in inventory holding among Jordanian industrial firms, which might be related to the differences in firms characteristics, internal finance, and the ability to raise funds externally, which affects the variations of inventory investment among firms. Moreover, these variations might be related to different industrial sectors that firms belong to.
- Sales have mean value of 30.9, with standard deviation, estimated to be 88.7, while the minimum value equal to 0.031, and maximum value is 847. This means that there is a high volatility in sales.

- The leverage ratio which is measured by total liability divided by total assets has a mean value of 0.312 with standard deviation estimated to be 0.203. The leverage ratio has a minimum value of 0.001, and a maximum value equals 0.859. This variation may be related to the dissimilarity of a firms' ability to raise funds externally (short-term, long-term debt), which depends on some characteristics of firms like the risk, profitability, assets,….etc.
- The mean value of cash flow is 0.047, standard deviation is estimated to be 0.120. The cash flow ranged between -0.349 as a minimum value, and 0.615 as a maximum value, which indicates that there is a high volatility in cash flows among firms.
- The mean value of size of industrial firms which are included in the study is about 16.478, with an estimated standard deviation of about 1.408. The firm size ranges between a minimum value of 13.221, and a maximum value of 20.925. The difference in the size of the firms attributed to the difference in the size of total assets for each firm, because the study uses the total assets as a proxy to split firms into large and small firm.

5.3 The Estimation Results of the Model

Table (5.2) presents the estimation results of the empirical model (4.2). The result implies that the panel data analysis is better than the pooled data analyses for estimating the empirical model of inventory investment. This finding comes out from the significant value of Langragian Multiplayer (LM) where the Ch^2 value is estimated to be 22.67 with p-value of 0.000<0.05, suggesting the presence of firm and time specific effect, as a result the OLS regression will not be efficient to estimate the empirical model.

To determine whether to use the fixed effect model (FEM) or random effect model (REM) in estimating the panel data, Hausman test was performed. Hausman test is found to be statistically significant at 1% level, where the Ch^2 is 41.55 with p-value of (0.000<0.05). Therefore, the null hypothesis that the random effect model is appropriate in estimating the model can be rejected, and the alternative hypothesis that the fixed effect model is appropriate in estimating the model will be accepted. Therefore, the fixed effect model will be the preferred model

for estimating the panel data set. The discussion of the results will be restricted to the fixed effect random, which has been found to be the best

Table 5.2

The Estimation Results of Model (4.2)

Independent Variables	Fixed Effect Model	Random Effect Model
Cons.	16.2491 (0.000)*	9.4393 (0.000)*
Target inventory(TD)	0.3513 (0.019)**	0.3210 (0.021)**
DUM-CON	2.5625 (0.433)	2.3672 (0.376)
INVTD.CON	0.0862 (0.050)**	0.0625 (0.054)**
Change in sales	0.1417 (0.003)**	0.2535 (0.000)*
Leverage	0.3180 (0.804)	1.735 (0.059)**
Cash Flow	0.1820 (0.020)**	0.2810 (0.000)*
OBSERVATIONS	446	446
R-sq (over all)	0.4459	0.4835
F-statistic	4.03 (0.0001)*	
Chi^2 Hausman test	Chi^2 =41.55 Prob> Chi^2=(0.0000)*	
Chi^2 Heteroskedasticity test	Chi^2 =1.023 Prob> Chi^2=(0.235)	
Langrangian Multiplier	Chi^2 =22.67 Prob> Chi^2=(0.0000)*	

*,**,*** denote variable is significant at 1%, 5%, 10% level respectively. DUM-CON: is a dummy variable of financial constraints. INVTD.CON: is the target inventory by interacting the financial constraints.

For the purpose of testing the presence of heterskedasticity problem, the current study uses the Bressch-Pagan test under the null hypothesis that the variance of error term is homogeneous. Bressch-Pagan test is found to be statistically insignificant at 5% (*p-value*=0.235<0.05). Implying that we can't reject the null hypothesis that the variance of error term is homogeneous, and hence the heterskedasticity problem does not exist for the sample of the study.

The estimation results for the study model which is presented in Table (5.2) show the following:

-There is a significant positive relationship at 5% between change in sales and inventory investment. It is found that the coefficient of change in sales variable is 0.1417 with p-value 0.003. This indicates that the growth in sales positively affects the level of inventory. Firms with high level of sales tend to increase their level of inventory. This result in line with Obembe *et al*. (2012), and Sangalli, (2013) who find a positive relationship between sales growth and inventory investment. Moreover, Small (2000) finds that the change in sales has a positive impact on inventory investment.

-There is a significant positive relationship at 5% between inventory investment and cash flow; Table (5.2) reveals that the coefficient of cash flow is 0.1820 with a p-value of 0.02. This result is consistent with Carpenter *et al.* (1994), Carpenter *et al.* (1998), and Cunha & Paisana (2011) who find that the cash flow has a significant positive impact on inventory investment. Moreover, Fazzari & Petersen (1993) find that investment in working capital is highly sensitive to the fluctuation in cash flow. This indicates that firms depend heavily on internal funds to finance their working capital including inventory. This supports the study hypothesis that cash flow has a significant positive effect on inventory investment. With respect to Jordanian industrial firms, the result indicates that Jordanian industrial firms depend on internal funds (cash flow) to finance their inventory. This may be attributed to the imperfection of capital market that may restrict firms from raising external funds at lower cost, and consequently, this makes them depend on internal funds as the cheapest way of financing.

-There is an insignificant relationship between leverage ratio (LEV) and inventory investment; the coefficient of leverage ratio is 0.3180 with a p-value of 0.804. This means that the leverage does not have any impact

on inventory investment. This result contradicts Sangalli (2013) and Bagliano & Sembenelli (2004) who find a significant negative relationship between leverage ratio and inventory investment. While the result is in line with Mathuva (2013), who finds insignificant effect of leverage on inventory investment. The study results indicate that Jordanian firms do not heavily use the financial leverage (long-term debt) in financing their inventory and depend on internal finance. The reason behind this is that inventory is a current asset, which is one of the working capital components, so Jordanian firms follow an aggressive policy in financing their inventory by heavily relying on short-term debt in case of insufficient internal funds.

As can be seen, from table (5.2), the estimation results of model (4.2) suggest that Jordanian industrial firms have a target inventory level, and they move gradually toward it when any deviation exists. This finding is assured by the significant of TD_{it} variable at 5% level (p-value=0.019<0.05). Moreover, this result supports the study hypothesis that Jordanian industrial firms have a target inventory level. Moreover, the speed of adjustment toward the target level at Jordanian industrial firms is estimated to be about 35.13% annually. Indicating that

Jordanian firms do partially adjust their level of inventory toward the target level. The immediate adjustment required a premium on purchasing costs, due to fast delivery in small amounts (Yue, 2011).

Few of empirical studies predict the speed of adjustment toward the target level. Bo *et al*. (2002) report that the speed of adjustment is 0.398 for Dutch manufacturing firms. Carpenter *et al*. (1994) find that the adjustment speed is between 13%-30% a quarter for U.S. manufacturing firms. Saggar (2003) estimates the speed of adjustment on Indian firms between 30%-46% per annum in the three sub-period, and 26% for the full period. Obembe *et al*. (2012) report that the speed of adjustment for Nigerian firms is 47%. Mathuva (2013) on his research on developing countries, finds that the speed of adjustment for Nairobi firms is 48%.

The speed of adjustment for Jordanian industrial firms is lower than their counterparts in both developed and developing countries. One explanation to the low adjustment speed of Jordanian firms is the presence of transaction cost. The transaction cost will affect inversely the speed of adjustment. Thus, as the transaction cost increases as the speed of adjustment declines, and firms need more time in order to adjust their

inventory toward the target level. The presence of market imperfection in Jordan imposes many financial restrictions which prevent firms from raising funds at a reasonable cost, and restricts them from making quick adjustment due to the transaction costs involved.

-To investigate whether the financial constraints have an impact on inventory investment, this study splits firms into financially constrained/unconstrained relative to their size (Total asset). A dummy variable (DUM-CON) is used to indicate the financial position, which is equal to 1 if a firm is financially unconstrained and 0 if otherwise.

Since the INVTD.CON variable is significant at 5% (p-value=0.050), then the coefficient of TARGINV(TD), which is found to be 0.3513, will differ among constrained and unconstrained firms. Therefore, the coefficient of TARGINV(TD) for unconstrained firms will be found by adding the coefficient of TARGINV(TD) to the coefficient of INVTD.CON.

Table (5.3) presents the estimation results of financially constrained and unconstrained firms. As can be seen the estimated coefficient on TD_{it} variable for unconstrained firms is found to be, on average, 0.4375, while

for constrained firms it is found to be, on average, 0.3513. This indicates that being financially constrained has an impact on the level of inventory holdings. So, firms that suffer from being financially constrained tend to reduce their level of inventory beyond the target level, and need more time to adjust toward it. This is consistent with the study hypothesis that the financial constraints have an impact on the level of inventory holding. Moreover, this result is in line with several studies which conclude that the financial constraints have an impact on inventory investment (Cunha & Paisana, 2011 ; Sangalli, 2013 ; Bagliano & Sembenelli, 2004).

-Since the financial constraints have an impact on the level of inventory holding, the financially constrained firms need more time than others to reach their optimal level. This can be verified from the coefficient of TD variable, which is a measure of the speed of adjustment toward the target level. It is found that the speed of adjustment for constrained firms is lower than it is for the unconstrained firms. The speed of adjustment for unconstrained firms is 43.75%, while for constrained firms it is 35.13%, which means that financially constrained firms adjust their target level of inventory slower than others. This result is in line with the study

hypothesis that financially constrained firms move slower than financially unconstrained firms toward the target level. The reason behind this is attributed to the fact that the unconstrained firms have little financial constraints than constrained firms, so they can raise funds externally at lower costs than constrained firms, which in turn makes the unconstrained firms adjust toward the target inventory level faster than constrained firms.

Table (5.3)

The estimation results of model (4.2) among financially constrained/unconstrained firms

Independent Variables	**Fixed Effect Model**	
	Un-const.	**Const.**
Cons.	16.2491 (0.000)*	16.2491 (0.000)*
TARGINV (TD)	0.4375 (0.025)**	0.3513 (0.025)**

*,**,*** denote variable is significant at 1%, 5%, 10% level respectively. TARGINV (TD): is the target inventory variable. This table is calculated with reliance on table (5.2), by adding the coefficient of Target inventory(TD) to the coefficient of INVTD.CON to get the coefficient of TARGINV (TD) for unconstrained firms.

Chapter six

Conclusion and Recommendation

6.1 Introduction

This chapter summarizes the main findings of this study and provides the conclusions and the recommendations.

6.2 Summary of Research Results

The study aims at investigating whether Jordanian industrial firms have a target inventory investment, and how fast they move toward it when any deviation exists. Moreover, it aims to identify the effect of financial constraints on inventory investment, relative to the target level and the speed of adjustment. The study uses a panel data for Jordanian industrial firms listed in ASE over the period (2001-2011). Since this is the first study that is conducted on the effect of financial constraints on inventory investment, in developing country, Jordan, this study sheds a new light on this subject especially when there are a few studies on this subject.

The regression results show a sensitivity of inventory investment to internal funds (cash flow) for Jordanian industrial firms, which might be

due to the financial restrictions that face those firms in imperfect capital market, which in turn makes these firms heavily dependent on internal funds to finance their inventory investment. So, any fluctuation in internal funds will affect the level of inventory holding.

The results reveal that the leverage ratio has no impact on inventory investment; this indicates that Jordanian industrial firms do not use the financial leverage (long-term debt) in financing their inventory investment. This is because the inventory item, which is one of the working capital items, is a current asset, which means that these firms use short-term debt to finance their inventory when the internal funds are insufficient.

Moreover, the results indicate that Jordanian industrial firms have a target inventory, and move slowly toward their target. The results show that the speed of adjustment for Jordanian firms is lower than their counterparts in other developed and developing countries. The estimates of the speed of adjustment for constrained and unconstrained firms indicates that the unconstrained firms move toward their target levels faster than constrained firms.

The slow adjustment speed for Jordanian industrial firms can be explained by the high transaction cost for adjusting toward the target level. These high transaction costs prevent firms from raising funds externally, which in all, affect the average speed of adjustment. The results also indicate that being financially constrained has an impact on the level of inventory and on the speed of adjustment toward the target level.

6.3 Recommendations

Based on the results of this study, the study recommends the following:

1. Since the cash flow is found to have a significant positive effect on the level of inventory investment, Jordanian industrial firms need to focus more on improving their cash flow holding in order to maintain their level of inventory.

2. Jordanian industrial firms might need to concentrate more on a good management of inventory investment to decrease the required time needed for adjustment toward the target level. Since inventory is an important item of the working capital, good management of inventory

positively affects working capital, which in turn has an impact on the profitability of the firm.

3. The study also recommends that the capital market in Jordan need to be developed toward more efficiency to increase the firm's ability in raising funds externally, by increasing the protection level of investors, the market liquidity, and the transparency.

4. Despite of the scarcity of studies on the impact of financial constraints on inventory investment in Jordan in particular and in developing countries in general, this study provides an empirical guide using Jordanian firms' status. Further research could be conducted to explore the effect of financial constraints on inventory investment by using firms in another developing countries.

5. In addition, the study recommends conducting a new research using Jordanian industrial firms to explore the other determinant factors that may have an impact on the level of inventory holdings.

6. Finally, the study recommends to investigate whether the impact of financial constraints on optimal inventory levels differ in accordance to the type of industrial sectors.

6.4 Limitations

During the process of preparing this study the researcher faced some problems such as:

1. The lack of databases and the lack of disclosures for Jordanian industrial firms impose more restrictions on the researcher to collect the data set. So, it is needed to develop valid databases for the Jordanian firms to simplify the process of collecting data.

2. The scarcity of studies on the effect of financial constraints on inventory investment conducted in developing countries, imposes a restriction in comparing the results of this study with similar studies in such countries.

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Appendix (A)

List of Jordanian Industrial Firms Included in the Study

No.	Symbol	Name
1	APCT	ARAB COMPANY FOR INVESTMENT PROJECTS
2	GENM	GENERAL MINING COMPANY PLC
3	AALU	ARAB ALUMINIUM INDUSTRY /ARAL
4	ICAG	THE INDUSTRIAL COMMERCIAL & AGRICULTURAL
5	NAST	NATIONAL STEEL INDUSTRY
6	DADI	DAR AL DAWA DEVELOPMENT & INVESTMENT
7	JOWM	THE JORDAN WORSTED MILLS
8	JOCF	JORDAN CERAMIC INDUSTRIES
9	JOPC	JORDAN PAPER AND CARDBOARD FACTORIES
10	JOPH	JORDAN PHOSPHATE MINES
11	JOPI	THE JORDAN PIPES MANUFACTURING
12	JOTN	JORDAN TANNING
13	APHC	ARAB CENTER FOR PHARM.& CHEMICALS
14	AJFM	AL-JANUOB FILTERS MANUFACTURING
15	JOIC	JORDAN CHEMICAL INDUSTRIES
16	UNIC	UNIVERSAL CHEMICAL INDUSTRIES
17	GENI	GENERAL INVESTMENT
18	WOOL	AKARY FOR INDUSTRIES AND REAL ESTATE INVESTMENTS
19	INJM	INDUSTRIAL INDUSTRIES & MATCH/JIMCO
20	WOOD	JORDAN WOOD INDUSTRIES / JWICO
21	WIRE	NATIONAL CABLE & WIRE MANUFACTURING
22	JOSL	JORDAN SULPHO-CHEMICALS
23	JOCIM	THE JORDAN CEMENT FACTORIES
24	APOT	THE ARAB POTASH
25	UCVO	AL-QARIA FOOD & VEGETABLE OIL INDUSTRIES CO. P.L.C
26	JOWL	JORDAN ROCK WOOL INDUSTRIES
27	EICO	AL-EQBAL INVESTMENT COMPANY LTD
28	UMIC	UNIVERSAL MODERN INDUSTRIES
29	NATC	NATIONAL CHLORINE INDUSTRIES
30	JOIR	JORDAN INDUSTRIAL RESOURCES
31	JNCC	MIDDLE EAST SPECIALIZED CABLES COMPANY/MESC_JORDAN
32	ELZA	EL-ZAY READY WEAR MANUFACTURING
33	JOST	JORDAN STEEL

34	**AEIN**	**ARAB ELECTRICAL INDUSTRIES**
35	**MPHA**	**MIDDLE EAST PHARMA. & CHMICAL IND. & MEDICAL**
36	**UTOB**	**UNION TOBACCO & CIGARETTE INDUSTRIES**
37	**IENG**	**RUM ALADDIN INDUSTRIES**
38	**ICER**	**INTERNATIONAL CERAMIC INDUSTRIES**
39	**PERL**	**PEARL- SANITARY PAPER CONVERTING**
40	**INOH**	**COMPREHENSIVE MULTIPLE PROJECT COMPANY**
41	**NATA**	**NATIONAL ALUMINIUM INDUSTRIAL**
42	**NDAR**	**NUTRI DAR**
43	**ASPMM**	**ARABIAN STEEL PIPES MANUFACTURING**
44	**EKPC**	**AL-EKBAL PRINTING AND PACKAGING**
45	**UADI**	**UNION ADVANCED INDUSTRIES**
46	**INTI**	**INVESTMENTS AND INTEGRATED INDUSTRIES CO. PLC**
47	**JVOI**	**JORDAN VEGETABLE OIL INDUSTRIES**
48	**SLCA**	**INTERNATIONAL SILICA INDUSTRIAL**
49	**TRAV**	**TRAVERTINE COMPANY LTD**
50	**MECE**	**MIDDLE EAST COMPLEX FOR ENG., ELECTRONICS AND HEAVY**